

Patterns and Correlates of Physical Activity Among US Women 40 Years and Older

ABSTRACT

Objectives. This study describes the patterns of physical activity among minority women by using a variety of definitions and determines sociodemographic and behavioral correlates of physical activity in this population.

Methods. A cross-sectional study was conducted in 1996 and 1997 among US women 40 years and older ($n = 2912$) of the following racial/ethnic groups: African American, American Indian/Alaskan Native, Hispanic, and White.

Results. Physical activity was lowest among African Americans and American Indians/Alaskan Natives (adjusted odds ratios [ORs] for no leisure-time activity were 1.35 [95% confidence interval (CI) = 1.08, 1.68] and 1.65 [95% CI = 1.33, 2.06], respectively). A much higher proportion of women were classified as being physically active when occupational activity rather than more traditional assessments of leisure activity were used to determine level of physical activity. On the basis of a composite definition of physical activity, 72% of respondents reported being physically active. Women living in rural regions (OR = 1.33; 95% CI = 1.12, 1.58) were more likely than urban inhabitants to be completely inactive during leisure time.

Conclusions. Minority women are among the least active subgroups in American society, although not all groups are less active than White women when all domains of physical activity are taken into account. (*Am J Public Health*. 2000;90:264–270)

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A large body of research has established that for postmenopausal women, regular physical activity reduces the risk of premature death and disability from a variety of health conditions, including coronary heart disease, type 2 diabetes mellitus, colon cancer, osteoarthritis, and osteoporosis.¹ In the United States, the annual number of lives lost through physical inactivity is estimated at more than 250 000,² and relatively small increases in the population prevalence of physical activity could avert 30 000 to 35 000 deaths per year.³ Public health recommendations have evolved to emphasize a "lifestyle" approach to increasing activity that includes common activities such as brisk walking, climbing stairs, doing housework and yard work, and engaging in active recreational pursuits.^{1,4} All adults are recommended to accumulate at least 30 minutes per day with an intensity equivalent to walking at 3 to 4 miles per hour for most healthy adults.^{4,5} This level of activity is believed to be realistic and achievable for the vast majority of adults.

Efforts to increase physical activity have been a focal point of important public health initiatives such as *Healthy People 2000*⁶ and, more recently, *Healthy People 2010*.⁷ In a recent assessment of progress in meeting national health objectives in the area of physical activity, 13 physical activity objectives were examined. Of these, 1 has surpassed the target (i.e., worksite fitness programs), 6 show progress toward the year 2000 target (e.g., moderate physical activity), 5 are moving away from the target (e.g., overweight prevalence), and 1 lacks the data for evaluation (e.g., community fitness facilities).⁸

Large national surveys have shown that women are less likely to be physically active than men.¹ In addition, certain demographic groups (e.g., African American women) appear to be especially at risk for physical inactivity.¹ However, studies of prevalence and correlates to date have been limited for several reasons. First, it is unclear how many of the racial/ethnic differences in physical activity can be explained by socioeconomic variables such as level of educa-

tion.^{9–13} Second, few studies have included representative samples of American Indian/Alaskan Native women. Third, little research is published on women 40 years and older, who are at increased risk of both physical inactivity and chronic diseases. And finally, there are few data based on a comprehensive definition of physical activity, including activity during leisure time, on the job, and around the house.

To add information to these topics, we recently conducted a large, cross-sectional survey of physical activity in women (i.e., the US Women's Determinants Study). Our purpose in this article is to report the results of this study by (1) describing the patterns of physical activity among minority women by using a variety of definitions and (2) determining sociodemographic and behavioral correlates of physical activity in this population.

Methods

Study Population

We collected data via a telephone survey, using a modified version of the sampling plan of the Behavioral Risk Factor Surveillance

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System (BRFSS).¹⁴⁻¹⁶ These methods have been described in detail elsewhere¹⁷ and will be discussed briefly here. To obtain a nationally representative but cost-efficient sample of minority women 40 years and older, zip codes were selected that had more than 20% of one of the following racial/ethnic categories: African American, American Indian/Alaskan Native, Asian American/Pacific Island, and Hispanic. Although Asian American women were included in the pilot survey, they were excluded from the final sample because of a high nonresponse rate (i.e., more than twice as many calls before an interview was completed among Asian or Pacific Island women than among women of other racial/ethnic groups).

Because only zip codes with more than 20% of the desired population were chosen, appropriate measures were taken to ensure that the sample had a proportionality similar to that of the total population. Proportional-to-size sampling was conducted by ranking the zip codes for each of the minority groups by the racial/ethnic population per zip code. These lists were then divided into quartiles. For each quartile, a percentage of the minority population relative to the minority population of the total sample was computed. From this percentage, 100 zip codes were chosen proportionally and randomly from each of the minority zip code lists that served as the final sampling frame from which telephone numbers were generated. These zip code lists were then computer matched with telephone prefixes. From this sampling frame, a standard multistage cluster technique for random telephone numbers was followed as in the standard BRFSS.¹⁵ Since zip codes and telephone prefixes do not match up with absolute certainty, a zip code screening question was included at the beginning of the survey.

Only those who lived within the chosen zip codes and met the other survey criteria (i.e., female; 40 years and older; African American, American Indian/Alaskan Native, or Hispanic) were surveyed. In addition to the minority groups, a comparison group of White women 40 years and older was surveyed by standard BRFSS random-digit dialing techniques.¹⁴⁻¹⁶ Surveys were conducted in English. Four attempts were made to contact a person at each selected number. If contact could not be made after 4 attempts, another number was selected from the same primary sampling unit.

Instrumentation

We developed the survey instrument by using a combination of questions from the BRFSS, the National Health Interview Survey, and other surveys.^{14,15,18-23} Several topic

questions were specifically developed for this survey method (telephone) and population (middle- and older-aged minority women). When valid and reliable scales were available, every effort was made to use them in their entirety. In a few cases, items were adapted for use in a telephone survey (e.g., asking a "yes/no" question rather than employing a checklist that would be used in an in-person interview). The final instrument contained a total of 92 questions (including skip patterns), with an average administration time of 29 minutes. Questions on physical activity behavior focused on leisure-time physical activity, occupational activity, and activity around the house.

Since physical activity behavior shows seasonal variation, the data were collected over a 1-year period. Interviews were completed during the first 2 weeks of every month from July 1996 through June 1997. Experienced interviewers who underwent at least 8 hours of training specific to this project conducted the interviews. The response rate was calculated according to the method of the Council of American Survey Research Organization (CASRO) and was based on the ratio of completed interviews to the sum of completed interviews, refusals, and a standard fraction of telephone numbers that were working but were either busy or not answered after multiple attempts.²⁴ The CASRO response rate was 87.3%. A test-retest study of the questionnaire, showing adequate reliability for items on physical activity behavior, is reported elsewhere.¹⁷

Definitions of Physical Activity

Based in part on public health recommendations²⁴ and metabolic equivalent values of various activities,²⁵ several standard categories have been developed for physical activity analyses.²⁶ One metabolic equivalent corresponds to the amount of energy (oxygen) a person expends while sitting quietly at rest (approximately 3.5 mL of oxygen per km of body weight). We used these indexes as well as others that were available²⁷ given that data were collected for domains both within and outside of leisure-time physical activity. The following definitions were used:

1. *No leisure-time physical activity:* no exercise, recreational, or physical activities (other than regular job duties) during the past 2 weeks.
2. *Regular physical activity:* participation in leisure-time physical activity at least 5 times per week and for at least 30 minutes per session (corresponds to *Healthy People 2000* objective 1.36).
3. *Vigorous physical activity:* participation in leisure-time physical activity at least

3 times per week and for at least 20 minutes per session with a medium or large increase in heart rate (corresponds to *Healthy People 2000* objective 1.46).

4. *Occupational physical activity:* participation in at least 300 minutes per week of "vigorous" job tasks, including walking, lifting/carrying, and other activities of similar exertion.

5. *Housework physical activity:* participation in at least 300 minutes per week of "vigorous" household chores, including vacuuming/mopping, digging/planting, lifting/carrying, and other chores of similar exertion.

6. *Composite:* a subject who met any one of the preceding definitions for regular, vigorous, occupational, or housework physical activity was considered "active" as opposed to "inactive."

The 300-minute cutoff point for occupational and housework activity was based on the premise that common occupational and housework activities have approximately one half the metabolic equivalent values of "regular" activities such as brisk walking used in definition 2 above. An individual will need to perform lower-intensity activities for a longer time (e.g., 60 minutes rather than 30 minutes per session) to achieve health benefits comparable to those of higher-intensity activities. In our definitions, some individual activities could be classified in 2 domains (e.g., gardening might appear as both a leisure-time and a housework activity).

Other behavioral risk factors were defined as follows:

- *Ever smoked:* smoked more than 100 cigarettes in lifetime.
- *Current smoker:* smoked more than 100 cigarettes in lifetime and currently smokes.
- *Five-a-day fruit/vegetable consumption:* consumption of an average of 5 or more servings of fruits and vegetables per day.
- *Overweight:* body mass index (BMI; weight in kilograms divided by height in meters squared) greater than 27.3.

Data Analysis

Following data collection, risk factor data were cleaned and edited by standard BRFSS quality control procedures.^{14,15} All analyses used the Statistical Package for the Social Sciences (SPSS, Inc, Chicago, Ill). After editing, data were weighted to compensate for poststratification by age, sex, and race. Since telephone surveys tend to oversample certain subpopulations (e.g., older persons) and nonresponse tends to be unequal across subpopulations (e.g., income and education groups), weighted prevalence esti-

mates provide a better representation of the overall population prevalence. Crude and multivariate adjusted odds ratios and 95% confidence intervals were calculated to compare the level of physical activity by various sociodemographic and behavioral risk categories. In developing models based on multiple potential confounders, we added independent correlates to the model if they had been consistently shown to be significant predictors of physical activity in other national studies.¹ The variables included in the modeling included race/ethnicity, age, and education level. Income level was not included in the modeling because of that variable's high collinearity with education level.

Results

Among the sample of 2912 women, each racial/ethnic group was well represented, with sample sizes ranging from 660 to 769 per racial/ethnic category (Table 1). Younger women and those with a high school education or less were slightly overrepresented. The majority of the women sampled reported household incomes of less than \$35 000 per year.

For the 6 definitions of physical activity reported in Table 2, statistically significant variation ($P < .10$) across racial/ethnic groups was shown for each index except for occupational activity. Physical activity tended to be lowest among African Americans and American Indians/Alaskan Natives. For example, among the 5 indexes showing significant racial/ethnic variation, activity was lowest or second lowest for each of these among African Americans. American Indians/Alaskan Natives showed the highest proportion of no leisure-time activity, the second-lowest rate of regular activity, and the lowest rate of vigorous activity. A much higher proportion of women were classified as physically active when the level of physical activity was based on occupational activity than when it was based on more traditional assessments of leisure activity. When a composite definition of physical activity was used, nearly three quarters of respondents reported being physically active.

Sociodemographic and behavioral correlates for 4 definitions of physical activity were examined (Table 3). The findings described below are based on adjusted effect estimates. Although multivariate adjustment attenuated effect estimates, several statistically significant results remained according to racial/ethnic category. Women who were African American (odds ratio [OR] = 1.35; 95% confidence interval [CI] = 1.08, 1.68) or American Indian/Alaskan Native (OR = 1.65; 95% CI = 1.33, 2.06) were more likely to be

TABLE 1—Characteristics of Participants in the US Women's Determinants Study, 1996–1997

Characteristic	n	%
Racial/ethnic group		
White	769	26.4
African American	745	25.6
American Indian/Alaskan Native	738	25.3
Hispanic	660	22.7
Total	2912	
Age group, y		
40–49	1121	38.5
50–59	760	26.1
60–69	592	20.3
70+	439	15.1
Education		
Less than 4 years of high school	788	27.1
4 years of high school	697	30.8
Some college or technical school	616	21.2
4 years of college	409	14.0
Postcollege	197	6.8
Unknown/missing	5	0.2
Income, \$		
<10 000	560	19.2
10 000 to <20 000	610	20.9
20 000 to <35 000	575	19.7
35 000 to <50 000	394	13.5
≥50 000	300	10.3
Unknown/missing	473	16.2
Marital status		
Married	1655	56.8
Divorced/separated	551	18.9
Widowed	538	18.5
Never married	161	5.5
Other/missing	7	0.2
Urban/rural location		
Urban	1096	37.6
Suburban	220	7.6
Rural	1242	42.7
Between rural and urban	267	9.2
Missing	87	3.0

completely inactive (no leisure-time activity) than White women. The probability of being active during leisure time also tended to increase with increasing educational level. Women living in rural regions were 33% more likely to be completely inactive during leisure time than were women living in urban areas. Among behavioral risk factor categories, having no leisure-time activity was most common among current smokers, persons not consuming 5 or more servings of fruits and vegetables per day, and those who were overweight.

For the category of regular exercise, African American women were less likely to be active, and Hispanics were more likely to be active, than White women. Regular exercise was most common in the age group 60 to 69 years (OR = 1.55; 95% CI = 1.14, 2.13) and least common among overweight persons (OR = 0.69; 95% CI = 0.54, 0.87). Occupational physical activity was most common among American Indians/Alaskan Natives (OR = 1.47; 95% CI = 1.06, 2.02)

and among women who were college graduates (OR = 1.52; 95% CI = 1.06, 2.18). The housework category showed considerable variation. Housework activity was most common among American Indians/Alaskan Natives (OR = 1.33; 95% CI = 1.08, 1.65) and Hispanics (OR = 1.34; 95% CI = 1.08, 1.67). Older women were least likely to be active according to the housework algorithm. Women who were college graduates were less likely to be active according to the housework category, as were women who were not married. Rural residents were most likely to be active in the home (OR = 1.21; 95% CI = 1.03, 1.43).

For respondents who reported some leisure-time activity during the past 2 weeks, the 8 most common activities were walking (66.7% of respondents), aerobics (6.5%), gardening (5.0%), bicycling (4.2%), calisthenics (2.2%), stretches/light calisthenics (2.0%), swimming/water exercises (1.6%), and treadmill use (1.5%). The frequency of the

TABLE 2—Prevalence of Physical Activity by Racial/Ethnic Group: US Women's Determinants Study, 1996–1997

Definition	Total Population % (95% CI)	White % (95% CI)	African American % (95% CI)	American Indian/ Alaskan Native % (95% CI)	Hispanic % (95% CI)	χ^2 (P)
No leisure ^a	36.7 (34.9, 38.5)	30.7 (27.4, 34.0)	37.2 (33.7, 40.7)	49.7 (45.0, 52.4)	32.5 (28.9, 36.1)	42.19 (<.001)
Regular activity ^b	10.9 (9.8, 12.0)	11.3 (9.1, 13.6)	8.4 (6.3, 10.5)	9.4 (7.2, 11.6)	14.6 (11.8, 17.4)	6.30 (.098)
Vigorous activity ^c	11.0 (9.8, 12.2)	13.0 (10.6, 15.5)	7.9 (5.9, 9.6)	7.6 (5.6, 9.9)	13.8 (11.1, 16.5)	12.72 (.005)
Occupational activity ^d	68.7 (67.0, 70.4)	66.0 (62.6, 69.4)	65.3 (61.8, 68.8)	73.4 (70.1, 76.7)	71.0 (67.5, 74.5)	4.46 (.216)
Housework ^e	53.1 (51.2, 54.9)	49.4 (45.9, 53.1)	50.6 (46.9, 54.3)	58.1 (54.5, 61.7)	57.6 (53.8, 61.4)	11.21 (.011)
Composite ^f	72.3 (70.7, 73.9)	71.7 (68.5, 74.9)	66.5 (63.0, 70.0)	74.0 (70.8, 77.2)	76.8 (73.5, 80.1)	7.29 (.063)

Note. CI = confidence interval.

^aNo exercise, recreational, or physical activities (other than regular job duties) during the past 2 weeks.

^bParticipation in leisure-time physical activity ≥ 5 times per week and ≥ 30 minutes per session.

^cParticipation in leisure-time physical activity ≥ 3 times per week and ≥ 20 minutes per session with a medium or large increase in heart rate.

^dParticipation in ≥ 300 minutes per week of vigorous job tasks including walking, lifting/carrying, and other activities of similar exertion; limited to women who were employed (full-time, part-time, or self-employed).

^eParticipation in ≥ 300 minutes per week of vigorous household chores including vacuuming/mopping, digging/planting, lifting/carrying, and other chores of similar exertion.

^fMeeting any one of the preceding definitions for regular, vigorous, occupational, or housework physical activity.

8 most common activities was calculated for various sociodemographic categories (Table 4). Walking was far more common than any other leisure activity. The prevalence of walking tended to be slightly higher among American Indians/Alaskan Natives and Hispanics. Among women reporting some leisure-time activity during the past 2 weeks, walking was also most common among those with lower education and lower income. In some instances, the proportion of women participating in various activities varied widely across sociodemographic strata. For example, aerobics was much more common among younger women (40 to 49 years), and it was 3.7 times more common among women with household incomes of \$50 000 or higher than among those reporting incomes of less than \$10 000. Swimming/water exercises were 3 times more common among older women (70 years and older) than among younger women (40 to 49 years).

Discussion

Although there are few data with which to compare our results, our findings appear generally consistent with other national data on racial/ethnic patterns of physical activity in the United States. In the 1992 BRFSS, no leisure-time physical activity was highest among African American women (42.7%), followed by Hispanics (39.0%) and White women (28.2%).¹ In the 1991 National Health Interview Survey of adults 18 years and older, the prevalence of inactivity was highest among Hispanic women (37.4%), followed by African American women (33.2%) and White women (24.6%).² These 2 surveys did not report results for American Indians/

Alaskan Natives. In our study, adjusted rates of no leisure-time activity were highest for American Indians/Alaskan Natives, followed by African Americans, Hispanics, and Whites. Although it is generally known that minority women are among the least active subgroups in American society, our study shows that not all groups are less active than White women when all domains of physical activity are taken into account. A major finding of this study is that about three quarters of a sample of lower-socioeconomic-level, ethnic minority women report being active enough to achieve health benefits when all types of physical activity are taken into account. Large proportions of women in all groups reported substantial amounts of physical activity in occupational and household tasks. The extent of activities in these settings was unexpected, so these findings need to be confirmed with objective measures of physical activity (e.g., pedometers, heart rate monitors). Other surveys have shown that older women are more likely to be physically inactive.¹ Our data showed that women 70 years and older were more likely to be inactive in unadjusted analyses; however, after multivariate adjustment, these age differences were diminished.

Data such as ours can be used in targeting high-risk populations and in designing interventions. Behavioral risk factors correlated mainly with no leisure-time physical activity, which is generally consistent with other studies.^{28,29} These data suggest that increasing physical activity may help change these risky behaviors. For example, there is some evidence^{30,31} that participation in physical activity may have a positive impact on smoking cessation. For 2 indexes, overweight women were less active, suggesting that

interventions should continue to be directed at overweight minority women. Because walking is perhaps the most acceptable and accessible exercise activity³² and its health benefits are increasingly recognized,^{33,34} environmental and policy interventions^{35,36} that provide safe and attractive places to walk are especially needed for minority women. We observed that walking was by far the most common type of physical activity, a finding consistent across racial/ethnic and socioeconomic strata.

Our study also has important implications related to the accurate quantification of physical activity among women. More research is needed on how to efficiently obtain data on moderate physical activity by using telephone interviewing. Our data, and those of others,^{37,38} illustrate that studies of women need to take into account all "domains" of physical activity, including leisure-time exercise, activity on the job, and housework.

When our study began, we also intended to sample Asian/Pacific Island women. Owing to sampling procedures, language difficulties, and perhaps cultural barriers (e.g., less willingness to discuss health issues), our approach was inefficient for reaching these women and they were excluded from the sample following pilot testing. More efforts are needed to determine an effective and efficient sampling approach for this group of women.

One strength of our study is that it was based on standardized methods (e.g., the BRFSS^{14,15} and Waksberg design¹⁶) and used standard questions whenever possible. We also developed comprehensive measures of physical activity that took into account public health recommendations¹⁴ and activity on the job or in the home. In addition, the relatively

TABLE 3. Multivariate Correlates of Physical Activity: US Women's Determinants Study, 1996-1997

Category	No Leisure*		Regular Activity*		Occupational Activity*		Housework*	
	Crude OR (95% CI)	Adjusted OR* (95% CI)	Crude OR (95% CI)	Adjusted OR* (95% CI)	Crude OR (95% CI)	Adjusted OR* (95% CI)	Crude OR (95% CI)	Adjusted OR* (95% CI)
Race/ethnic group								
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
African American	1.59 (1.29, 1.97)	1.35 (1.08, 1.68)	0.61 (0.43, 0.87)	0.63 (0.44, 0.90)	1.03 (0.76, 1.41)	1.14 (0.83, 1.58)	1.13 (0.93, 1.39)	1.07 (0.87, 1.32)
American Indian/ Alaskan Native	1.89 (1.53, 2.33)	1.65 (1.33, 2.06)	0.95 (0.69, 1.32)	1.00 (0.72, 1.40)	1.38 (1.01, 1.88)	1.47 (1.06, 2.02)	1.47 (1.20, 1.80)	1.33 (1.08, 1.65)
Hispanic	1.07 (0.85, 1.34)	0.92 (0.73, 1.16)	1.53 (1.13, 2.08)	1.52 (1.18, 2.21)	1.20 (0.87, 1.66)	1.29 (0.93, 1.78)	1.50 (1.12, 1.85)	1.34 (1.08, 1.67)
Age group, y								
40-49	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50-59	0.98 (0.81, 1.18)	0.88 (0.73, 1.07)	1.28 (0.96, 1.72)	1.33 (0.99, 1.79)	0.98 (0.76, 1.27)	1.00 (0.78, 1.30)	0.87 (0.73, 1.05)	0.85 (0.70, 1.02)
60-69	0.83 (0.67, 1.02)	0.70 (0.57, 0.87)	1.42 (1.05, 1.93)	1.55 (1.14, 2.13)	0.85 (0.59, 1.22)	0.92 (0.63, 1.33)	0.81 (0.66, 0.99)	0.79 (0.64, 0.97)
70+	1.31 (1.04, 1.63)	1.09 (0.86, 1.37)	1.01 (0.70, 1.46)	1.17 (0.80, 1.71)	0.88 (0.35, 2.21)	0.98 (0.39, 2.46)	0.50 (0.40, 0.63)	0.49 (0.39, 0.62)
Education								
Less than 4 years of high school	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4 years of high school	0.76 (0.63, 0.92)	0.75 (0.62, 0.91)	0.88 (0.64, 1.19)	0.94 (0.69, 1.29)	1.16 (0.82, 1.62)	1.16 (0.82, 1.63)	1.09 (0.90, 1.32)	1.01 (0.83, 1.23)
Some college	0.53 (0.42, 0.66)	0.51 (0.41, 0.64)	1.03 (0.74, 1.43)	1.17 (0.83, 1.63)	1.30 (0.91, 1.87)	1.32 (0.92, 1.91)	0.99 (0.80, 1.22)	0.92 (0.73, 1.14)
4 years of college	0.44 (0.35, 0.55)	0.42 (0.34, 0.54)	1.05 (0.76, 1.46)	1.21 (0.86, 1.70)	1.49 (1.05, 2.12)	1.52 (1.06, 2.18)	0.80 (0.64, 0.98)	0.73 (0.58, 0.91)
Income, \$								
<10,000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10,000 to <20,000	0.92 (0.73, 1.16)	0.99 (0.78, 1.26)	0.79 (0.54, 1.14)	0.82 (0.56, 1.21)	1.12 (0.73, 1.73)	1.09 (0.70, 1.69)	1.27 (1.01, 1.60)	1.19 (0.93, 1.51)
20,000 to <35,000	0.81 (0.64, 1.03)	0.95 (0.74, 1.23)	0.87 (0.60, 1.26)	0.97 (0.65, 1.44)	1.47 (0.95, 2.27)	1.37 (0.86, 2.17)	1.17 (0.93, 1.48)	1.13 (0.88, 1.46)
35,000 to <50,000	0.67 (0.51, 0.88)	0.87 (0.64, 1.17)	1.11 (0.75, 1.64)	1.33 (0.86, 2.00)	1.82 (1.16, 2.85)	1.63 (0.99, 2.68)	1.21 (0.93, 1.57)	1.24 (0.92, 1.66)
>50,000	0.52 (0.38, 0.70)	0.70 (0.50, 1.00)	1.36 (0.90, 2.03)	1.78 (1.09, 2.89)	1.44 (0.91, 2.26)	1.27 (0.75, 2.14)	1.19 (0.89, 1.57)	1.23 (0.88, 1.71)
Marital status								
Married	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Divorced/ separated	1.15 (0.95, 1.41)	1.15 (0.94, 1.41)	0.94 (0.70, 1.27)	0.97 (0.72, 1.31)	0.87 (0.66, 1.15)	0.88 (0.67, 1.16)	0.70 (0.58, 0.85)	0.70 (0.57, 0.85)
Widowed	1.01 (0.90, 1.34)	0.99 (0.79, 1.23)	0.80 (0.58, 1.09)	0.75 (0.53, 1.07)	0.80 (0.53, 1.21)	0.87 (0.56, 1.34)	0.62 (0.51, 0.75)	0.76 (0.61, 0.95)
Never married	1.22 (0.88, 1.70)	1.24 (0.89, 1.73)	0.53 (0.28, 1.00)	0.59 (0.31, 1.11)	0.80 (0.52, 1.26)	0.82 (0.53, 1.29)	0.67 (0.48, 0.92)	0.68 (0.48, 0.92)
Urban/rural location								
Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Suburban	1.19 (0.88, 1.60)	1.12 (0.83, 1.53)	0.90 (0.56, 1.44)	0.80 (0.50, 1.28)	1.10 (0.70, 1.72)	1.07 (0.67, 1.70)	1.05 (0.80, 1.42)	1.00 (0.74, 1.35)
Rural	1.47 (1.24, 1.73)	1.33 (1.12, 1.58)	0.91 (0.70, 1.18)	0.92 (0.71, 1.20)	1.16 (0.90, 1.49)	1.21 (0.94, 1.56)	1.29 (1.09, 1.52)	1.21 (1.03, 1.43)
Between rural and suburban	0.95 (0.71, 1.26)	0.90 (0.68, 1.21)	1.24 (0.84, 1.84)	1.24 (0.84, 1.85)	1.29 (0.84, 1.98)	1.31 (0.85, 2.02)	1.28 (0.97, 1.68)	1.24 (0.94, 1.63)
Smoking status								
Never smoked	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Former smoker	0.99 (0.82, 1.20)	1.05 (0.86, 1.27)	0.94 (0.71, 1.25)	0.97 (0.73, 1.29)	0.98 (0.72, 1.28)	0.94 (0.70, 1.25)	0.94 (0.78, 1.13)	0.98 (0.81, 1.18)
Current smoker	1.43 (1.18, 1.73)	1.42 (1.17, 1.73)	0.81 (0.59, 1.10)	0.87 (0.63, 1.19)	0.89 (0.67, 1.18)	0.92 (0.70, 1.23)	1.05 (0.87, 1.27)	0.98 (0.81, 1.20)
Five-a-day fruit/ vegetable consumption								
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.71 (0.59, 0.85)	0.75 (0.62, 0.91)	1.19 (0.92, 1.56)	1.21 (0.93, 1.58)	1.24 (0.93, 1.64)	1.22 (0.92, 1.61)	0.95 (0.79, 1.13)	1.00 (0.83, 1.19)
Overweight								
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	1.64 (1.40, 1.91)	1.50 (1.28, 1.76)	0.69 (0.54, 0.87)	0.69 (0.54, 0.87)	1.01 (0.80, 1.27)	1.04 (0.83, 1.32)	1.06 (0.92, 1.24)	1.02 (0.87, 1.18)

Note. OR = odds ratio; CI = confidence interval.

*No exercise, recreational, or physical activities (other than regular job duties) during the past 2 weeks.

†Participation in leisure-time physical activity 25 times per week and 230 minutes per session.

‡Participation in 2300 minutes per week of vigorous job tasks including walking, lifting/carrying, and other activities of similar exertion; limited to women who were employed (full-time, part-time, or self-employed).

§Participation in 2300 minutes per week of vigorous household chores including vacuuming/mopping, digging/planting, and other chores of similar exertion.

*Adjusted for race/ethnicity, age, and education level.

TABLE 4—Percentages of Various Specific Activities Engaged in by Women Reporting Leisure-Time Activity* in the Past 2 Weeks, by Sociodemographic and Behavioral Risk Subgroup: US Women's Determinants Study, 1996–1997

Category	Walking	Aerobics	Gardening	Bicycling	Callisthenics	Stretches/Light Callisthenics	Swimming/ Water Exercises	Treadmill
Racial/ethnic group								
White	62.1	8.8	5.4	4.9	2.4	1.3	2.8	0.6
African American	66.0	6.0	4.0	4.7	2.0	4.0	0.7	0.7
American Indian/ Alaskan Native	67.2	5.1	4.7	4.3	1.7	2.6	0.9	3.0
Hispanic	69.9	7.4	4.3	3.7	1.8	2.5	3.1	1.2
Age group, y								
40–49	62.0	11.4	3.0	3.7	1.7	1.7	1.5	0.2
50–59	69.5	6.2	4.8	5.5	1.4	2.1	2.1	2.1
60–69	65.9	4.7	6.5	3.4	3.9	2.2	2.2	1.3
70+	61.9	4.5	8.4	5.8	1.9	2.6	4.5	1.3
Education								
Less than high school graduate	69.0	6.0	5.0	5.0	2.0	4.0	1.0	1.0
High school graduate	64.1	5.5	5.5	5.8	1.6	1.9	2.3	1.6
Some college	64.1	8.0	4.6	3.4	1.9	1.5	3.4	0.8
College graduate	64.1	10.0	4.9	3.6	2.9	1.3	1.6	1.3
Income, \$								
<10 000	67.1	4.3	3.7	6.8	3.1	3.7	1.9	0.0
10 000–<20 000	67.9	7.3	5.2	4.7	2.1	3.1	1.0	0.5
20 000–<35 000	65.1	6.9	5.0	2.3	0.9	0.5	1.8	1.4
35 000–<50 000	71.0	5.1	5.1	5.1	0.6	2.3	2.3	1.7
≥50 000	56.6	15.7	5.0	3.8	2.5	0.6	2.5	0.0

*Does not include occupational or housework activities.

large size of the sample allowed us to estimate proportions by racial/ethnic group and to examine a variety of other sociodemographic factors, using multivariate adjustment.

Two main limitations of our study should be noted. First, we relied on self-reported telephone survey data that may underrepresent some segments of the population.³⁹ Because we based our sample on zip codes with more than 20% of the racial/ethnic group of interest and because interviews were conducted in English, our survey overrepresents concentrations of some minority groups (e.g., a higher likelihood of representing American Indians living on reservations). According to 1990 census information for the zip codes we sampled, telephone coverage was reasonably high for the racial/ethnic groups sampled. The percentages of households with telephones within the zip codes sampled were as follows: White, 92.6%; African American, 92.1%; American Indian/Alaskan Native, 86.1%; Hispanic, 88.8%. These data are consistent with earlier reports of lower telephone coverage among American Indians.⁴⁰

Second, our instrument has not been extensively tested among subgroups of interest. Test-retest results for our study show that discordance for regular physical activity varied from 4% among American Indians/Alaskan Natives to 20% among Hispanics.¹⁷ In some instances (e.g., regular leisure-time activity among African American women), reliability coefficients were low.¹⁷ Other stud-

ies of BRFSS questions have shown relatively wide variations in the reliability of physical activity measures among various racial/ethnic groups, with discordance rates generally lowest among Whites.^{41–43} Although we conducted pilot testing, our instrument was not extensively examined for cultural competence. The surprisingly high prevalence of occupational physical activity raises the possibility of response bias, so these items should be investigated further. In addition, our study instrument did not capture "intermittent" leisure-time activity (i.e., accumulating bouts of 10 minutes of physical activity in the same day), which is the focus of recent public health recommendations.⁴ Although the present definition of physical activity was more inclusive than most, women who accumulated at least 300 minutes per week across multiple domains were not classified as active.

In summary, our study shows substantial gaps between racial/ethnic groups of women in the United States in the prevalence of physical activity after adjustment for age and education level. For example, after multivariate adjustment, American Indian/Alaskan Native women were 65% more likely to be completely inactive during leisure time than were White women. However, the relationships become more complicated when other forms of physical activity (e.g., on the job, in the home) are examined. American Indian/Alaskan Native women were more likely than White women to have reported at least

300 minutes per week of occupational activity or housework. Since almost all epidemiologic studies have examined the effects of leisure-time physical activity on the risk of various health conditions, research is needed to determine whether physical activity on the job or in the home confers similar health benefits. There are also limited qualitative data suggesting that exercising by choice (i.e., leisure time) may relieve stress better than housework or workday activities,⁴⁴ perhaps indicating differing mental health benefits. Walking was the most common type of physical activity for all subgroups, so walking should be emphasized in physical activity interventions for minority women. □

Contributors

R. C. Brownson conceptualized the original study and wrote the draft of the paper. A. A. Eyster, A. C. King, D. R. Brown, and J. F. Sallis helped in designing the questionnaire and contributed to the writing and revision of the paper. A. A. Eyster provided day-to-day oversight of data collection. Y.-L. Shyu conducted the analyses and contributed to the writing and revision of the paper.

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References

- US Dept of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, Ga: Centers for Disease Control and Prevention; 1996.
- Hahn RA, Teutsch SM, Rothenberg RB, Marks JS. Excess deaths from nine chronic diseases in the United States, 1986. *JAMA*. 1990;264:2654-2659.
- Powell KE, Blair SN. The public health burden of sedentary living habits: theoretical but realistic estimates. *Med Sci Sports Exerc*. 1994;26:851-856.
- Pate RR, Pratt M, Blair SN, et al. Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 1995;273:402-407.
- Blair SN, Connelly JC. How much physical activity should we do? The case for moderate amounts and intensities of physical activity. *Res Q Exerc Sport*. 1996;67:193-205.
- US Dept of Health and Human Services. *Healthy People 2000: National Health Promotion and Disease Prevention Objectives*. Washington, DC: Public Health Service; 1991. DHHS publication PHS 91-50212.
- Healthy People 2010. US Dept of Health and Human Services. 1998. Available at: <http://web.health.gov/healthypeople>. Accessed December 19, 1999.
- US Dept of Health and Human Services. *Healthy People 2000 Review 1998-99*. Hyattsville, Md: Public Health Service; 1999. DHHS publication PHS 99-1256.
- Folsom AR, Cook TC, Sprafka JM, Burke GL, Norsted SW, Jacobs DR Jr. Differences in leisure-time physical activity levels between blacks and whites in population-based samples: the Minnesota Heart Survey. *J Behav Med*. 1991;14:1-9.
- Shea S, Stein AD, Basch CE, et al. Independent associations of educational attainment and ethnicity with behavioral risk factors for cardiovascular disease. *Am J Epidemiol*. 1991;134:567-582.
- Washburn RA, Kline G, Lackland DT, Wheeler FC. Leisure time physical activity: are there black-white differences? *Prev Med*. 1992;21:127-135.
- Ransdell LB, Wells CL. Physical activity in urban white, African-American, and Mexican-American women. *Med Sci Sports Exerc*. 1998;30:1608-1615.
- Winkleby MA, Kraemer HC, Ahn DK, Varady AN. Ethnic and socioeconomic differences in cardiovascular disease risk factors. *JAMA*. 1998;280:356-362.
- Gentry EM, Kalsbeek WD, Hogelin GC, et al. The Behavioral Risk Factor Surveys: design, methods, and estimates from combined state data. *Am J Prev Med*. 1985;1:9-14.
- Remington PL, Smith MY, Williamson DF, Anda RF, Gentry EM, Hogelin GC. Design, characteristics, and usefulness of state-based behavioral risk factor surveillance: 1981-1987. *Public Health Rep*. 1988;103:366-375.
- Waksberg J. Sampling methods for random digit dialing. *J Am Stat Assoc*. 1978;73:40-46.
- Brownson RC, Eyster AA, King AC, Shyu Y-L, Brown DR, Homan SM. Reliability of information on physical activity and other chronic disease risk factors among women aged 40 years or older, United States. *Am J Epidemiol*. 1999;149:379-391.
- Adams PF, Marano MA. Current estimates from the National Health Interview Survey, 1994. National Center for Health Statistics. *Vital Health Stat 10*. 1995;No. 193.
- Centers for Disease Control and Prevention. Monthly estimates of leisure-time physical activity—United States, 1994. *MMWR Morb Mortal Wkly Rep*. 1997;46:393-397.
- Sallis JF, Grossman RM, Pinski RB, Patterson TL, Nades PR. The development of scales to measure social support for diet and exercise behaviors. *Prev Med*. 1987;16:825-836.
- Sallis JF, Hovell MF, Hofstetter CR, et al. Distance between homes and exercise facilities related to the frequency of exercise among San Diego residents. *Public Health Rep*. 1990;105:179-185.
- Hovell MF, Hofstetter CR, Sallis JF, Rauh MUD, Barrington E. Correlates of change in walking for exercise: an exploratory analysis. *Res Q Exerc Sport*. 1992;63:425-434.
- Brownson RC, Mayer JP, Dussault PG, et al. Developing and evaluating a cardiovascular risk reduction project. *Am J Health Behav*. 1997;21:333-344.
- CASRO Task Force on Completion Rates. *On the Definitions of Response Rates. Special Report*. New York, NY: Council of American Survey Research Organizations; 1982.
- Ainsworth BE, Haskell WL, Leon AS, et al. Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sports Exerc*. 1993;25:71-80.
- Brownson RC, Heath GW, Jones DA, Blanton C, Pratt M. Measuring physical activity with the Behavioral Risk Factor Surveillance System: analytic methods and future directions. *Med Sci Sports Exerc*. In press.
- Fischer ID, Brown DR, Blanton CJ, Casper ML, Croft JB, Brownson RC. Physical activity patterns of Chippewa and Menominee Indians: the Inter-Tribal Heart Project. *Am J Prev Med*. 1999;17:189-197.
- Wankel LM, Sefton JM. Physical activity and other behaviors. In: Bouchard C, Shephard RJ, Stephens T, eds. *Physical Activity, Fitness, and Health*. Champaign, Ill: Human Kinetics; 1994:530-550.
- Johnson ME, Nichols JF, Sallis JF, Calfas KJ, Hovell MF. Interrelationships between physical activity and other health behaviors among university women and men. *Prev Med*. 1998;27:536-544.
- King TK, Marcus BH, Pinto BM, Emmons KM, Abrams DB. Cognitive-behavioral mediators of changing multiple behaviors: smoking and a sedentary lifestyle. *Prev Med*. 1996;25:684-691.
- Marcus BH, Albrecht AE, King TK, et al. The efficacy of exercise as an aid for smoking cessation in women: a randomized controlled trial. *Arch Intern Med*. 1999;159:1229-1234.
- Siegel PZ, Brackbill RM, Heath GW. The epidemiology of walking for exercise: implications for promoting activity among sedentary groups. *Am J Public Health*. 1995;85:706-710.
- Pereira MA, Kriska AM, Day RD, Cauley JA, LaPorte RE, Kuller LH. A randomized walking trial in postmenopausal women. *Arch Intern Med*. 1998;158:1695-1701.
- Hakim AA, Petrovitch H, Burchfiel CM, et al. Effects of walking on mortality among non-smoking retired men. *N Engl J Med*. 1998;338:94-99.
- King AC, Jeffery RW, Fidinger F, et al. Environmental and policy approaches to cardiovascular disease prevention through physical activity: issues and opportunities. *Health Educ Q*. 1995;22:499-511.
- Sallis JF, Bauman A, Pratt M. Environmental and policy interventions to promote physical activity. *Am J Prev Med*. 1998;15:379-397.
- Wilbur J, Miller A, Dan AJ, Holm K. Measuring physical activity in midlife women. *Public Health Nurs*. 1989;6:120-128.
- Ainsworth BE, Richardson M, Jacobs DR Jr, Leon AS. Gender differences in physical activity. *Women Sport Phys Activity J*. 1993;2:1-15.
- Centers for Disease Control and Prevention. *Using Chronic Disease Data: A Handbook for Public Health Practitioners*. Atlanta, Ga: Centers for Disease Control and Prevention; 1992.
- Sugarman JR, Warren CW, Oge L, Helgeson SD. Using the Behavioral Risk Factor Surveillance System to monitor year 2000 objectives among American Indians. *Public Health Rep*. 1992;107:449-456.
- Bowlin SJ, Morrill BD, Nafziger AN, Lewis C, Pearson TA. Reliability and changes in validity of self-reported cardiovascular disease risk factors using dual response: the Behavioral Risk Factor Survey. *J Clin Epidemiol*. 1996;49:511-517.
- Shea S, Stein AD, Lantigua R, Basch CE. Reliability of the Behavioral Risk Factor Survey in a triethnic population. *Am J Epidemiol*. 1991;133:489-500.
- Stein AD, Lederman RJ, Shea S. The Behavioral Risk Factor Surveillance System questionnaire: its reliability in a statewide sample. *Am J Public Health*. 1993;83:1768-1772.
- Eyster AA, Baker E, Cromer L, King AC, Brownson RC, Donatelle RJ. Physical activity and minority women: a qualitative study. *Health Educ Behav*. 1998;25:640-652.